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RICKETS.

ITS CAUSES AND PREVENTION.

A LECTURE

Delivered at the Manchester Clinical Hospital for Women and Children.

BY

T. C. RAILTON, M.D., Lond.,

Senior Assistant-Physician to the Clinical Hospital.

REPRINTED FROM "THE HEALTH JOURNAL."

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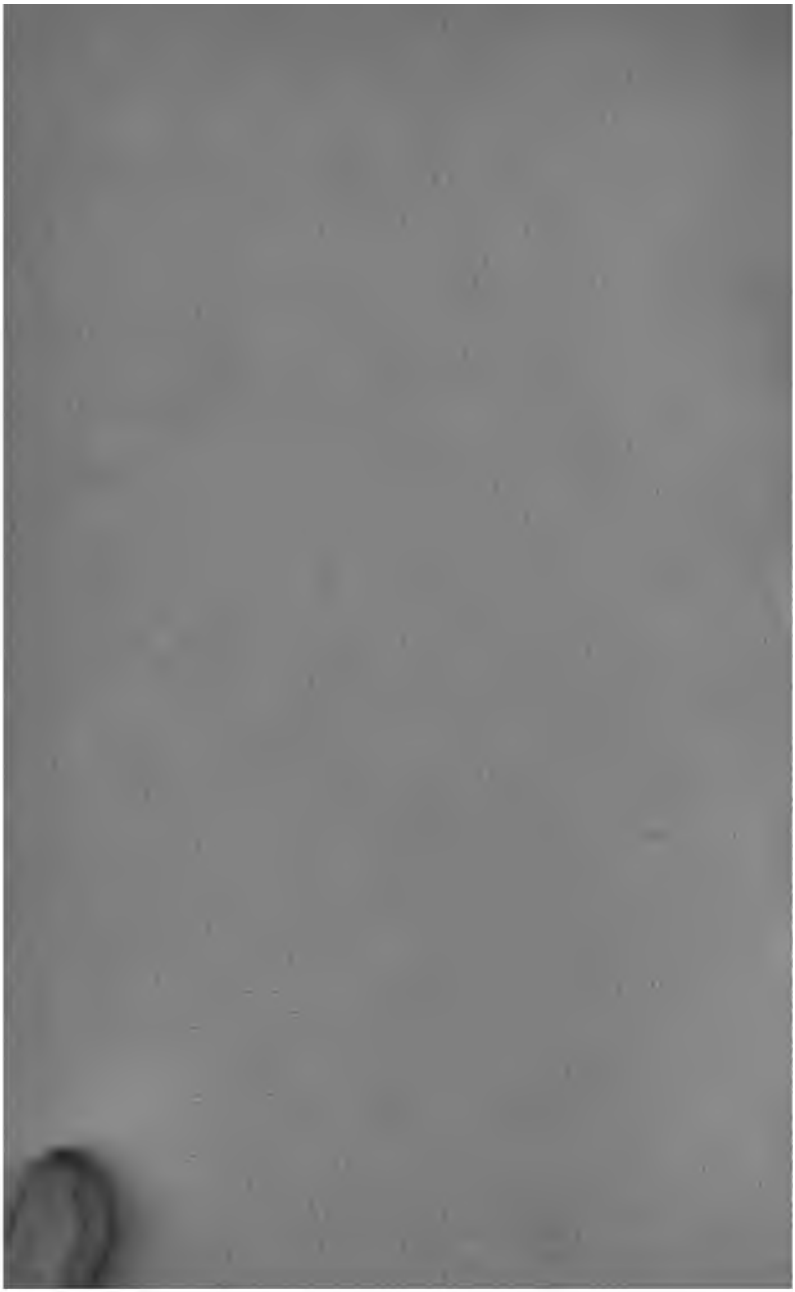

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RICKETS.

IN bringing before you such subjects as the diseases I am about to describe—that is "Rickets" to-day, and "Wasting in Infants" next week—I feel that perhaps you may think I am going a little beyond the scope of the lectures which have been arranged for delivery at this hospital. Certainly both these diseases are but rarely met with in the families of those who are well educated and well to do. But although it is unlikely that many of you can be practically acquainted with these diseases amongst your own relatives, it will do you no harm to learn a little about them, and, on the other hand, may do a great deal of good if you are able at some future time to make use of the knowledge. You may then be able to advise some poor ignorant woman, coming from the lower ranks of society, with whom you may, either voluntarily or accidentally, be brought into contact, as to the proper management of her child, and you may on such an occasion be the means of preventing disease, and perhaps even death. As you will hear, these diseases are often only seen by the doctor when the mischief is actually done. The advice which you may be able to give, just at the time when it is most needed, may perhaps do more good in preventing the disease than all the physic the child has subsequently to swallow, can do in curing it. Should you ever get into conversation with a poor woman with a child in her arms, if the child happens to be under six months old, that fact is quite sufficient an excuse for you to try to find out how she is feeding it. If you find that she is not feeding it properly—as I shall tell you presently—you can then teach her how it should be done.

I will now proceed with the short sketch I have to give you of rickets. This is a disease which in reality ought scarcely ever to be seen, for although one of the most common, it is one of the most preventible of children's

ailments. It is almost entirely produced by improper feeding. On this account it is often called a diet disease. It is pre-eminently a children's disease, and, as we shall see, is most common during the period of first dentition. Some knowledge as to its causes, symptoms and treatment is of importance to all and as a matter of course, particularly to mothers, since its prevention so frequently rests with them. Rickets is a serious disease if allowed to go on unchecked, for it often ends in most terrible deformity, as I will show you in the children I have had brought here this afternoon for the purpose. The deformity not alone renders the subject of it ugly to the sight—in itself a result which I suppose all right-thinking mothers will be anxious to avoid for their children—but, what is far more serious, disqualifies them to a greater or less degree for the ordinary duties of life, and in many ways tends to shorten their existence. Rickets is especially to be found among the children of the poor, and is particularly abundant in the densely-populated quarters of our towns. You can form some idea yourselves of the comparative frequency of the disease, from the number of people whom you meet with in our streets who are stunted in their growth and either bow-legged or knock-kneed, thus showing that they have at one time suffered from rickets. I do not however, wish you to think that all cases of rickets end in serious deformity. Fortunately a large number of cases are comparatively mild in character, partly perhaps, on account of having been submitted to proper treatment at an early stage, and partly because the causes producing the disease may not have been very strong. In such instances, the deformities which have occurred may have disappeared with the growth of the child, or may be too slight to attract your attention. About a *quarter* of all children under five years of age brought to such institutions as the Manchester Clinical Hospital are suffering from rickets. It might perhaps be some consolation to a victim to know that the illustrious author of the "Fables"—viz., Æsop, was rickety in his youth. You may be sure that he does not mention this fact in his writings; but he was ill-advised enough to allow a statue of himself to be erected, which statue, unfortunately for him, has recently been discovered. It unequivocally shows that he had suffered from rickets.

I propose to give you—firstly, the symptoms of the

disease, secondly, its causes and lastly, certain parts in its treatment.

The Symptoms.—I shall only give you the more prominent symptoms. I by no means intend to inflict upon you the whole of them, for that would take up too much of your time, and indeed, is not at all necessary for the purposes of this lecture. Rickets comes on insidiously, its earlier symptoms being not at all characteristic. In the large majority of cases the child shows signs of disturbance of the digestive organs in the beginning. This is a very important point to remember, for when we come to speak of the causes of the disease we shall find that most doctors consider the disorder to be produced in some way through this disturbance of digestion. The bowels become irregular and usually there is diarrhœa. This diarrhœa commonly persists more or less during the course of the disease. There are probably present also acid eructations, vomiting, and the abdomen becomes swollen with flatus or wind—all symptoms of indigestion. At the same time or very soon afterwards, the child becomes restless, pale and sickly-looking and shows symptoms of feverishness, particularly noticeable at night. The restlessness and kicking off the bedclothes, although a good deal thought of by everyone who writes about rickets, are hardly to be taken as symptoms by themselves, because as a rule, healthy children are very frequently exactly the same when they are asleep—at least, that is my experience. A more important symptom is found in the copious perspirations, sometimes of the whole body, but usually about the head and upper part of the chest. This perspiration may be most profuse, so that upon the head and face it stands out in big drops, and the pillow becomes quite wet where the child's head has been. It occurs particularly during sleep, but it is also seen in the day-time after exertion. It is a very rare thing to find the further symptoms of the disease coming on in children who have not previously passed through the above stage.

The earliest sign of the bones becoming affected is given by the child crying when his limbs are at all firmly grasped, and you may see the child sitting as quietly as he can, or even lying down and turning peevishly away if any one offers to take him up. These symptoms of tenderness in the bones occur frequently before there is any deformity to be

seen, and if they have been preceded by, or are accompanied by, those I have already mentioned, they are enough to lead one to suspect that rickets is coming on.

To give you an idea as to the time at which rickets generally commences, I will enumerate some figures comparing the frequency at different ages.

About 11 per cent begin during the first six months.
„ 29 „ „ „ second „
This amounts to 40 per cent during the first year.
38 per cent begin during the second year.
15 „ „ „ third „
3 „ „ „ fourth „
2 „ „ „ fifth „

We come now to the actual disease, when the fully developed symptoms admit of no further doubt. In the first place the process of teething is interfered with. From the preceding figures you will have noticed that this disease mostly occurs in children when they should be cutting their milk teeth. If the child has not already commenced to cut his teeth when rickets has begun, these fail to appear at the proper time, and it is quite a common thing to find a child without any teeth when a year old, or older still. If, as may happen, some teeth have appeared before rickets has commenced, the process of teething is stopped, and the next batch may be many months in coming. We may obtain in this manner an approximative notion of when the disease commenced, by reckoning that it began after certain teeth were cut, and stopped the advent of certain others due at such a period, and this point is as near the truth as we can hope to arrive. This stoppage in the appearance of the teeth is the most important symptom I have yet given, for this reason, it is one of the earliest and most constant. The rule I have always in my mind, is to examine for rickets, if a child is brought to me with a history of having cut the teeth too late or with irregularity.

Another symptom, equally characteristic of the disease, is the delay the child experiences in learning to walk. Instead *of being able to* walk when about a year old, as a healthy *child should, there* seems to be no attempt made; and if the

disease begins after the child has learnt to walk it takes him off his feet (as a mother often says), and he may not walk again for perhaps another year. Coincidently with the pain on being moved and the arrest of dentition, the changes which take place in the bones, ligaments and cartilages, and produce the deformities of the disease, gradually make their appearance.

The changes in the bones are of two kinds; in the first place there is an enlargement of the bones at their ends, or at their margins, according as they are long or flat. It is at the ends or margins that the most active growth is taking place. In the second place, there is a softening of the bone tissue, so that the bones become yielding and give way under various forces, depending mainly upon their position. The legs give way under the weight of the body if the child is placed upon his feet. Here and in other places the bones yield to the pulling of the muscles, and some, viz., the ribs, are deformed by the weight of the atmosphere in conjunction with muscular action. The actual growth of the bones is very much retarded by these processes, and unless the disease is quickly put a stop to, the normal increase in size of the child is much interfered with, and he remains small as well as being deformed.

I will briefly point out the manner in which the disease affects the different parts of the body. I dare say many of you are aware that the opening of a baby's head or, as medical men call it, the *anterior fontanelle*, should gradually become smaller and smaller as the bones around it grow, until, when the child is fifteen months old, it should be completely closed. This closure is quite stopped by rickets, and as the brain within still continues to grow, and by its pressure to expand the cavity of the skull, the *anterior fontanelle*, instead of closing, may actually increase in size. I have often seen in children of a year old, when the opening should barely admit the end of my finger, an opening considerably bigger than when the child was born.

Although a rickety child often appears to have a large head, this is really due to the fact that the face is smaller than natural, the bones having been delayed in their growth, while the head is, in a manner, compelled to continue growing even if its bones do not unite together, on account of the expansive force of the brain within. The head is in

consequence often flattened at the top after rickets, a deformity which will probably be permanent.

Then as regards the body: The softness of the bones allows the spine to give way in various directions, usually accentuating the natural curves. This deformity is assisted by a toneless condition which the muscles exhibit, as well as by the relaxation of the ligaments, and further serves in some degree to compensate for the deformity of the chest in front. The ribs become soft, so that they bend easily, and their ends become swollen at the points where they join the cartilages which connect them with the breast bone. This is what is known as the rickety chaplet or rosary. The softened ribs yield to the pressure of the atmosphere when the child draws in its breath, and the sides of the chest are then seen to be sucked in, forming a broad but shallow groove on each side. This distortion is much increased if the child suffers at all from bronchitis, a disease to which unfortunately, these patients appear to be almost as prone as the diarrhœa I have previously mentioned. The bending in of the ribs often throws forward the breast bone, producing what is known as the pigeon breast. The extremities suffer equally with the head and body. The enlargement of the ends of the bones is particularly noticeable at the wrist, which becomes what is sometimes called double-jointed.

The softened bones bend, generally in the direction of the natural curves. If the child is at all roughly handled, the bone of the arm, or the collar-bone, are not at all unlikely to break, though they do not break completely like the brittle bones of other people, but break at one side and bend at the other, something like the fracture of a fresh branch from a tree, so that it is called by surgeons a green-stick fracture. It may naturally be expected that the legs will suffer the most if the disease is not sufficiently severe to prevent the child walking. If the child has never walked, the weight of the body can have no effect in bending the softened bones of the legs, so that the only way in which these are distorted is by the action of the muscles, and the distortion is only slight, and consists in an exaggeration of the normal curves; but if the child is able to walk, and is not stopped from doing so either by its parents or by the progress of the disease, the bones give way in a very marked manner, and he becomes more and more bow-legged, or more and more knock-kneed,

the longer he goes on. The bones at the knees and ankles are swollen in the same way as the wrists. The relaxed ligaments at the joints give way, especially at the knees, adding to the deformity.

You have then, if you put these facts together, a picture of the disease sufficiently elaborated to enable you to recognise any case of it when at all developed:—The digestive disturbances; the restlessness and feverishness at nights; the sweating; the delayed dentition; the delayed walking; the delayed closure of the head; the beads on the ribs and deformity of chest; the enlarged wrists; the curvatures of spine and extremities.

I must add that when the disease subsides, as it usually does without producing a fatal issue, a good many of the deformities may disappear. The child may recover with no other sign left of the disease except the bow legs, distorted chest, and stunted growth. The enlargements at the ends of the bones disappear and leave no sign. But the limbs and chest and head frequently retain their distorted appearance, and mark the patient for life.

I will now pass on to the causes of rickets. It cannot be said that it is an hereditary disorder, we have no proof that a rickety father or mother will have a rickety child. This fact can be easily accounted for when we consider that the disease is essentially one of childhood, and that, with the exception of the deformities of the bones, it disappears entirely and leaves nothing behind it when once it is cured. A child may certainly be born weak and predisposed to disease of many kinds, and may thus fall an easier prey to rickets if not properly brought up, but if intelligently fed and nursed it will not become rickety. So far then it may be said that weakness of the father, and especially of the mother at the time she is carrying the child, may render the child more liable to suffer from rickets, because it is likely to be born in a weakly state, but there is no actual predisposition.

In this hospital I very rarely find that the mothers show any signs of having been rickety in their youth. Unfortunately, however, they show plenty of signs of having poor health themselves, and either from poverty, drunkenness or ignorance, are often the last persons I should think fit to bring up babies.

The most important of all causes is improper feeding.

An infant requires different food according to its age, and whatever food is given to it which is unsuitable will, if continued, tend to bring on the disease. There is scarcely a day passes in the out-patient room of this hospital without some such history as the following, of a child brought here with rickets. The mother brings a child, perhaps fifteen months old, in her arms. The child, she says, has had diarrhœa off and on for several months, and has now a very bad cough. We ask: "How many teeth has the child?" The answer is, "None." "Has he walked yet?" "No, sir." The child is then examined and is found to have the symptoms of rickets, some of which I have already given you. Then is asked the question: "Did you feed this child at the breast?" "No, sir, I could not; I had to go out to work." The child has been left in the daytime in the charge of some other woman, perhaps its grandmother, who from the first day of its existence has fed him upon improper food, probably bread and water, the mother giving him the breast when she comes home at night. The child's teeth not being cut causes no surprise; the fact that he does not attempt to walk perhaps after a time arouses a suspicion that something is wrong, and then probably the mother begins to think that the child must be paralysed. Most commonly, however, the child is brought for some other complaint, such as bronchitis, diarrhœa or convulsions, rather than for the real disease which is the underlying cause. It is unhappily, a necessity with some poor women to leave their little children to the care of other people while they go out to work. There is less blame to be attached to them than to those who are able to stay at home and nurse their own children and do so improperly. In these cases the disease is brought on by the mother, who begins, when the child is perhaps only a month old, to supplement the supply of milk from her breast by some form of farinaceous food, such as bread, corn-flour, arrowroot, etc.

Now, the digestion of farinaceous food is mainly carried on in the mouth, when any one is old enough to digest it at all; the saliva contains a digestive ferment which reduces these materials to a soluble sugar, and this when it reaches the stomach is absorbed into the system. In young children there is very little saliva during the early months of life and what is present is totally deficient in the essential ferment. All farinaceous food consequently passes down into the

stomach unaltered, it remains there without the gastric juice being able to act upon it, and speedily turns sour. It is not difficult to understand that a child soon shows signs of indigestion under these circumstances. The fermenting starchy foods in its stomach not only do no good in themselves towards the nourishment of the body, but they actually irritate the stomach, so that the gastric juice becomes altered and unfit for its functions, and the mother's milk, which might be quite enough by itself with a healthy stomach, is also prevented from being digested. I have been frequently told by mothers whom I have been endeavouring to teach the proper way of feeding their infants when they have shown me one suffering from rickets, that they have brought up all their other children on bread or corn-flour, and still they are healthy and not rickety. It is quite true that some children may be fed wrongly and still grow up without rickets, but it is because they have been strong children to begin with, and remain well (as grown up people often do) in spite of eating what is bad for them. It is certainly not from any power of digesting starchy foods.

Besides farinaceous food one frequently finds that milk is given in a feeding bottle, the smell of which when you take the cork out is sickening. It is odd that mothers can give such a bottle day after day to their infants without ever smelling to see whether the milk is fresh or not. There is milk fermenting in the bottle, and it is soon milk fermenting in the child's stomach. Diarrhœa and vomiting are the inevitable results. Children who are kept entirely upon their mother's milk are very rarely rickety, although this sometimes occurs. If the mother is very weak or has not sufficient animal food in her diet, her milk becomes indigestible and may bring on the disease in her child if he is kept too long at the breast after he has begun to show the early symptoms. At other times the child is not weaned at the right time (between 8 and 10 months), but may be kept at the breast even until he is over two years of age. This is sometimes done for convenience and cheapness, sometimes from the fear of the child becoming restless, and often to prevent further additions to the family. The milk deteriorates in quality, it ceases to nourish the child sufficiently, and we get then rickets beginning in a child who has cut all his teeth.

Other causes are given for the production of rickets, many of them very frequently associated with improper feeding, such are damp, cold, dirt, want of sunlight, want of fresh air, etc., in fact such conditions as we may readily find in scores of streets round about Oldham Road or Ancoats, etc., but it may fairly be questioned whether any one of these causes or even all put together will produce a case of rickets if the digestion of the child be kept in order.

I pass now to the *treatment* of the disease. This is to be considered under two heads--the preventive treatment and the curative treatment.

The first is the one which should occupy your attention more particularly; it is very much better for the mother to avoid running the risk of causing the disease in her child than to be prepared to assist the doctor when the disease has actually become established, however implicitly she may carry out his instructions

I have already said that improper feeding is the main and almost the sole cause of rickets. I am inclined to believe that ignorance on the part of mothers is really to blame for this. I think there are very few women, however low their position in the world may happen to be, who would willingly allow their infants to have food which is unfit for them, if they could only be made to realise the consequences. The difficulty is in forcing them to realise this. My experience here is, that when you tell a mother that her child has rickets through bad feeding, she does not believe you. She probably puts you down as a harmless lunatic; crazy on the subject of infant-feeding. The only way to affect her is to make her promise to carry out your directions, whether she understands them or believes in them or not. When she sees the child improving in health under the altered dietary, she is encouraged to go on, and is a convert to your views—until she has another baby. If the mother is able to feed the infant at her own breast, that is undoubtedly the proper course to be pursued. This is quite sufficient until the age of six or seven months is reached. No other kind of food ought to be allowed; there is no artificial food which can be regarded as an effectual substitute for good human milk, and in nine cases out of ten none is required. If, however, the mother for some reason or other is unable to feed the child, then something else has to be found. The best substitute for the

milk of the mother is, of course, the milk of some other woman. But wet-nurses are not easy to find, and are out of the question in the case of the poor. The next best substitute is the milk which is nearest in composition to that of a woman, viz., asses' milk. This also is an impossibility for the poor. Cows' milk is the only food which is obtainable by the majority of mothers, and although very different in its digestibilty to human milk, it might still serve as a good substitute if properly prepared. Nothing else however should be given, no bread and water, corn-flour, arrowroot or other abominations which the child cannot digest. When any previous child has been a sufferer from rickets, or when the mother or father is of delicate constitution, so that we may anticipate that the child is not likely to be very strong, it becomes all the more important to see that there is nothing but milk given.

It will perhaps be well to explain the difference between human and cow's milk. Both kinds of milk are alike in constituents; the difference between them is solely in the quantities of these.

	Cream.	Casein.	Sugar.	Salts.
Woman's milk	4·5	1·9	4·6	0·16 to 0·5
Cow's milk.....	4·0	4·0	5·5	0·3 to 0·9

The amounts of cream, sugar of milk and salts are so nearly alike that we need not consider them. It is the difference between the relative quantities of the curd or casein which makes the difference in the digestibility of the two kinds. The curd in woman's milk when allowed to solidify, does so only in partial degree. It never becomes quite solid, but rather like soft jelly. The baby's stomach has no difficulty with this; it is broken up and acted upon by the gastric juice with the greatest ease. The curd of cow's milk, on the other hand, as you all know, becomes much more solid; and after it has been given pure to an infant, by the action of the child's stomach it is pressed much closer, and becomes hard almost as cheese. The feeble movements of the stomach are powerless against such a mass, and under these circumstances the gastric juice can only act upon its outer surface, and consequently the digestion is retarded very much, and very often the lump passes out of the stomach before it has been completely dissolved. The result of this is easy to see. The child has the stomach-ache, it draws up

its legs, contracts the face from the pain and cries. This is by no means all that results from the use of undiluted cow's milk. The curd remaining too long in the stomach proceeds to do what it would do in any warm place, it ferments. Fermentation produces flatulence and acidity. These aggravate the pain and irritate the stomach. The repetition of this process will produce vomiting, diarrhœa and wasting of the child. It is necessary then to dilute the cow's milk with water, so as to reduce the quantity per cent of the curd, and to bring it more nearly like that of human milk in proportion and in the consistency of its clot. For infants under three months it is necessary to dilute the cow's milk with twice its bulk of water. It is unfortunate that in doing this you also dilute the cream and the sugar, which scarcely require it. This however is partially remedied by adding a little sugar to each bottle of milk.

I need scarcely mention further the farinaceous foods, except to say that they have a much worse chance of being digested than even pure milk, there being nothing in the stomach capable of acting upon them. Consequently they ferment, and when fermenting they produce a great deal more flatulence and an enormously greater quantity of acid than even the milk. I think you must have heard in previous lectures as to the proper management of feeding bottles, so that I will not take up your time with the subject to-day. More serious cases occur occasionally, in which it is found that cow's milk, even when properly diluted and given with every care as to its freshness, will still not digest. It becomes then a rather difficult problem to know how to feed the infant who cannot derive his nourishment from his mother or from a wet nurse, and with whom cow's milk will not agree. Within the last two or three years this question has been solved. The milk can be digested for the child before he takes it, by preparation with a fluid derived from the digestive organs of the pig. The practical objection which can be urged against it is that the price of the digestive fluid places it rather beyond the reach of those persons whose children are most likely to require it, while the slight amount of skill necessary in its application is, I am sorry to say, beyond their capacity.

Besides the fact that nothing but milk should be given during the first six months of life, we must not lose sight of

the feeding after that time. It has been shown by the table I gave you, that rickets, although most commonly commencing during the first year, is very nearly as common during the second. A child, even if he has commenced to cut his teeth at the proper time, may still have rickets if improperly fed. I am constantly meeting with mothers who are in the habit of giving tea to their young children, also ham, cheese, buttered toast, indeed anything which may happen to be upon the table for the use of themselves or their husbands. Such things need only be mentioned to be condemned. Plain bread and milk, broths, cocoa, bread and butter, light farinaceous puddings, fresh vegetables, these are what are required, and are good for a young child who has passed the age of eight or ten months.

The remainder of the preventive treatment may be summed up in very few words. It comprises the ordinary precautions to keep a child in good health, which are practicable enough among the better class, but are unfortunately out of the power of the poor. Such are warm clothing, pure dry air, said to be essential by some authorities, warm or tepid baths, especially with sea salt.

When the disease has begun the mother should at once place the child under the care of a medical man. The early symptoms, such as diarrhœa, or delayed dentition, ought to receive attention as soon as possible. Diarrhœa in a child should never be neglected, and the younger the child the more serious is it. If rickets does not follow the diarrhœa some other disease such as atrophy, may do so. So far as the mother's department in the treatment goes she can only redeem the wrong she has done by implicitly carrying out the doctor's directions as to diet, &c. Precautions rendered necessary by the disease are as follows : She must not take up the child by one arm, or she will run the risk of causing a green stick fracture of the bone. The child is not to be carried much in the arms, or allowed to stand or walk, lest deformities be thereby caused or increased. Nor should a soft bed be used at night for the same reason ; a tolerably hard hair mattress is the best, and in the daytime the child should be allowed to sit or lie upon a blanket spread upon the floor, with nothing at hand by which he may raise himself. Pure air whenever possible, a perambulator suitable for the child to lie down in it. These are very important aids to

the medical treatment which will be carried out by the doctor. The first step then is to ensure proper feeding according to the age of the child. The second is to check the diarrhœa or other complaints of the digestive organs. The third is to give remedies which tend to cure the disease. By far the most efficacious of these is cod liver oil. Even if rickets is not actually established, when perhaps the only sign is lateness in cutting the teeth, a few drops of cod liver oil given three times a day act wonderfully in assisting their appearance. It should be considered as an article of diet to be given in small doses when a child appears thin and pallid. It is well, however, to have the advice of a doctor in the first instance.

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